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DYEING CELLULOSE DERIVATIVES IN THE PRESENCE OF INORGANIC THIOCYANATES AND ORGANIC ACIDS

George W. Seymour and George C. Ward, Cumberland, Md., assignors to Celanese Corporation of America, a corporation of Delaware

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This invention relates to the dyeing of cellulose acetate or other organic derivative of cellulose textile materials and relates more particularly to an improved process for the dyeing of said textile materials in shades which are of improved fastness to light and to acid fading.

An object of this invention is the provision of an improved dyeing process whereby cellulose acetate or other organic derivative of cellulose textile materials may be dyed rapidly in deep, level shades which are of unusual resistance both to light and to acid fading.

Another object of this invention is to provide an improved solvent dyeing process for the rapid dyeing of cellulose acetate or other organic derivative of cellulose textile materials, wherein the dyebath employed is free of inflammable organic solvents yet highly effective when applied to cellulose acetate or other organic derivative of cellulose textile materials by dyeing methods involving mechanical impregnation.

Other objects of this invention will appear from the following detailed description.

In dyeing textile materials having a basis of cellulose acetate or other organic derivative of cellulose, it has been found that these materials are dyed more slowly than other textile materials since they are less absorbent and the dye liquor in the bath does not penetrate them as rapidly or as completely as it does other textile materials. Consequently, in order to obtain satisfactory dyeings in deep, non-fugitive shades, long periods of immersion and manipulation were required. Extended dyeing processes are obviously uneconomical and methods whereby cellulose acetate or other organic derivative of cellulose textile materials may be dyed rapidly by a continuous process are of great economic value, since a continuous process enables the cost of dyeing to be substantially decreased. In the case of certain dyestuffs, such as acid or direct cotton dyestuffs, for example, it is well known that the same have little or no affinity for cellulose acetate or other organic derivative of cellulose textile materials when the usual methods of applying said dyestuffs are employed. However, these dyestuffs possess many valuable characteristics and suitable methods of applying the same to cellulose acetate or other organic derivative of cellulose materials in a rapid and efficient manner have been the object of much investigation.

We have now found that textile materials having a basis of cellulose acetate or other organic derivative of cellulose may be dyed very rapidly by mechanical impregnation methods employing

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various types of dyestuffs, and deep, level shades of unusual fastness to acid and light fading may be obtained if the dye bath employed comprises an aqueous solution of a dyestuff for said cellulose acetate or other organic derivative of cellulose material containing a lower aliphatic acid and an inorganic swelling agent for the organic derivative of cellulose material. By employing our novel dye baths and applying the same by mechanical impregnation methods, dyeing may be effected in a matter of seconds. As a result of this novel advance in the art, continuous processes for dyeing cellulose acetate or other organic derivative of cellulose textile materials are quite feasible. The dye textile materials may be washed or scoured immediately after dyeing without any intermediate drying or the use of skying rolls to insure thorough penetration or absorption of the dyestuff by prolonging the time of contact of the dye liquor with the textile material. Thus, the dyeing operation may be carried out as a continuous process with a substantial reduction in cost due to the greatly increased capacity which is achieved because of the extremely rapid and continuous nature of the process.

Any suitable lower aliphatic acid may be employed in forming our novel dye bath. Examples of these lower aliphatic acids are acetic acid, propionic acid and butyric acid. The acid may be employed in amounts varying from about 20 to 40% on the weight of the aqueous bath. Optimum results are achieved employing acetic acid in an amount of from about 25 to 35% by weight of the dyebath.

As examples of inorganic swelling agents for the organic derivative of cellulose materials, there may be mentioned salts of thiocyanic acid, such as, ammonium thiocyanate, sodium thiocyanate and potassium thiocyanate. Optimum results are achieved employing sodium thiocyanate. The inorganic swelling agent may be present in amounts of from 2 to 30% on the weight of the dye bath. Preferably, we employ the thiocyanates in amounts of from about 3 to 10% by weight.

Various dyestuffs for organic derivative of cellulose materials may be employed in accordance with our novel process. As stated, these dyestuffs may be acid dyes which are ordinarily used for the dyeing of wool and direct cotton dyes which are ordinarily used for dyeing cotton and which do not possess any substantial affinity for organic derivatives of cellulose materials when applied by the methods usually employed for applying said acid or direct cotton dyestuffs. We may also employ those dyes which are relatively

insoluble in water and which are usually applied to organic derivative of cellulose materials in the form of aqueous dispersions. Mixtures of these dyestuffs may also be employed. When these dyestuffs are applied to the cellulose acetate or other organic derivative of cellulose textile materials by mechanical impregnation methods in aqueous lower aliphatic acid solutions containing an inorganic swelling agent for said materials, in accordance with our process, the resulting dyeings are of uniform depth and brilliance and are obtained with a relatively short immersion time. Little or no wash-down of the shade in subsequent washing and finishing operations is observed in the case of fabrics dyed by our novel process.

The amount of dyestuff dissolved in the dye bath will, of course, vary with the final shade desired in the material which is being dyed and may be from as low as 0.01% up to 8% based on the weight of the material to be dyed.

The dye liquor may be applied to the organic derivative of cellulose textile materials by padding, spraying or by other convenient method of mechanical impregnation and at a temperature of 20 to 60° C. Preferably, we maintain the dyebath at about 25° C. Thus, as a continuous process, a fabric may be unwound from a roll, passed through a solution of the dyestuff, then between nipping rolls of a padding mangle which are adjusted to remove excess dye liquor from the fabric, and the fabric then subjected directly to washing or scouring. The duration of the immersion of the fabric in the dye liquor is relatively short and may be from 1 to 15 seconds. If desired, the fabric may be processed through the padding mangle at speeds ranging up to 60 yards per minute.

Our process is applicable not only to the dyeing of fabrics but particularly valuable results are obtained when other organic derivative of cellulose textile materials such as staple fiber, in the form of a top or roving, or a tow of continuous filaments is dyed in accordance with our invention. Not only may faster and more uniform dyeings be obtained, but, as in the case of fabrics increased production may be achieved along with a substantial reduction in the amount of dyestuff necessary to obtain a desired shade.

The organic derivative of cellulose fabrics, staple fiber yarns or other textile materials dyed in accordance with our process may have a basis of cellulose esters or cellulose ethers. Examples of cellulose esters are cellulose acetate, cellulose propionate, cellulose butyrate, and mixed esters such as cellulose acetate-propionate and cellulose acetate-butyrate, while examples of cellulose ethers are ethyl cellulose and benzyl cellulose. The materials may be mixed materials containing organic derivatives of cellulose and yarns or fibers of other materials such as cotton, silk, wool, or regenerated cellulose and in this way differential dyeings may be obtained where the dyes used have an affinity for only one of the components of the mixed textile material.

In order further to illustrate our invention but without being limited thereto, the following examples are given:

Example I

A previously scoured fabric of a satin construction containing cellulose acetate yarn in both warp and filling is passed through a bath containing 1% Artol Blue GL (Color Index 833), 30% acetic acid and 5% sodium thiocyanate at 25° C.

and then squeezed through padding rollers to give 80% expression. It is then rinsed thoroughly in cold water and given a light soaping. The fabric is then dried on a tenter frame. The speed of the machine is so adjusted that the time between the entrance of the fabric into the dye bath and its entrance into the rinse bath is 6 seconds. A medium blue dyeing is obtained of excellent light fastness and resistance to gas fading.

Example II

A previously scoured fabric of a taffeta construction containing cellulose acetate yarn in both warp and filling is padded with a dye bath containing 2% Amanil Chrysophenine G Ex. Conc. (Color Index 365), 30% acetic acid and 5% sodium thiocyanate for 6 seconds at 25° C. and then rinsed immediately in cold water, soaped lightly and dried. The resulting fabric is dyed a golden yellow of excellent light fastness, washing fastness and resistance to gas fading.

Example III

A cellulose acetate tow comprising a plurality of filaments of 57,000 total denier is passed through a dye bath containing 0.033% Vitrolan Yellow GR, 0.033% Vitrolan Orange R, 0.017% (said Vitrolans, which are also known as Neolans, being premetallized and chrome dyestuffs) Artol Blue GL, 30% acetic acid and 5% sodium thiocyanate for 6 seconds at 25° C. and then rinsed immediately in cold water. The tow is dyed a green shade of good fastness to light, washing and good resistance to atmospheric fading. The tow may be cut into staple fibers and spun into yarns suitable for the production of carpeting or men's suiting fabrics due to the fastness of the dyeing.

It is to be understood that the foregoing detailed description is given merely by way of illustration and that many variations may be made therein without departing from the spirit of our invention.

Having described our invention, what we desire to secure by Letters Patent is:

1. Process for the coloration of organic derivative of cellulose textile materials, which comprises mechanically impregnating said textile material with a dyebath consisting of water, a dyestuff for said organic derivative of cellulose material, at least 20% by weight of a lower aliphatic acid, and from 3 to 10% of a salt of thiocyanic acid which is a swelling agent for the organic derivative of cellulose material.

2. Process for the coloration of cellulose acetate textile materials, which comprises mechanically impregnating said textile material with a dyebath consisting of water, a dyestuff for said cellulose acetate material, at least 20% by weight of a lower aliphatic acid, and from 3 to 10% of a salt of thiocyanic acid which is a swelling agent for the cellulose acetate material.

3. Process for the coloration of cellulose acetate textile material, which comprises mechanically impregnating said textile material with a dyebath consisting of water, a dyestuff for the cellulose acetate material, 20 to 40% by weight of acetic acid and from 3 to 10% by weight of sodium thiocyanate.

4. Process for the coloration of organic derivative of cellulose textile materials, which comprises passing textile material, having a basis of an organic derivative of cellulose, through a dyebath, consisting of water, a dyestuff for the

organic derivative of cellulose textile material, from 3 to 10% of a salt of thiocyanic acid which is a swelling agent for the organic derivative of cellulose textile material and at least 20% by weight of a lower aliphatic acid, for a period of from 1 to 15 seconds, subjecting the so-treated textile material to pressure, and rinsing and then drying dyed textile material.

5. Process for the coloration of cellulose acetate textile materials, which comprises passing textile material, having a basis of cellulose acetate, through a dyebath, consisting of water, a dyestuff for the cellulose acetate textile material, from 3 to 10% of a salt of thiocyanic acid which is a swelling agent for the cellulose acetate textile material and at least 20% by weight of a lower aliphatic acid, for a period of from 1 to 15 seconds, subjecting the so-treated textile material to pressure, and rinsing and then drying dyed textile material.

6. Process for the coloration of cellulose acetate textile materials, which comprises passing textile material, having a basis of cellulose acetate, through a dyebath, consisting of water, a dyestuff for the cellulose acetate textile material, 3 to 10% by weight of sodium thiocyanate and at least 20 to 40% by weight of acetic acid, for a period of from 1 to 15 seconds, subjecting the so-treated textile material to pressure, and rinsing and then drying dyed textile material.

GEORGE W. SEYMOUR.
GEORGE C. WARD.

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